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THE DEPARTMENT OF DEFENSE STATEMENT ON TECHNOLOGY AND MILITARY MANPOWER

by

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IMPACT OF TECHNOLOGY ON MILITARY FORCES

Technology as an Offset to Numbers

The disparity in military equipment investment between the Soviet Union and the United States amounted to $240 billion in the last decade. Our strategy to deal with this disparity recognizes that it is infeasible to compete directly with the Soviets in quantities of equipment built. To match the Soviets gun for gun, tank for tank, or missile for missile, we would have to roughly triple our production of weapons. Then, as those weapons were deployed, we would have to double the size of our peacetime Army to man them. Instead, our strategy aims to offset the Soviet advantage in numbers by applying technology to equip our forces (and those of our Allies) with weapons that outperform their Soviet counterparts. Fundamental to this strategy is the fact that the United States leads the Soviets by five to ten years in many of the basic technologies (e.g., microelectronics, computers, jet engines) which are critical to our advanced weapons.

Today the Warsaw Pact armies have deployed a tank force that is more than twice as large as that of NATO. A conventional estimate is that weapons such as tanks must be four times more effective to offset a two times numerical superiority. Our strategy is to provide an offset, not with tanks that are four times better, but instead to supplement our smaller tank force with a combination of anti-armor systems:

(1) Surveillance systems that allow us to observe the enemy forces at all times -- day or night, fair weather or foul, at any spot on the earth,

(2) Secure, jamproof information transmittal systems that tell the fire control center where a target is, not where it was,

(3) Positioning systems that give the precise location of our forces, and

(4) Guidance systems such that missiles, once fired, are independent of third party TV, wire, or laser guidance and can make a direct hit on a target with the first shot, even when countermeasures are employed.

We have made major advances during the past four years in technology critical to such military systems. By placing a sharp focus (and major funding) on critical areas, we have widened our lead over the Soviets -- a lead which I believe will be decisive in maintaining our overall qualitative advantage.

Let me illustrate by example the application of our technology to achieve the performance edge critical to air superiority. The Soviets today have superior ground forces in Europe and that situation is not likely to change in the foreseeable future. But even with this advantage it is hard to believe that they would initiate an armored assault if they could not control the air space over Europe.

Therefore, it is crucial that we maintain our superiority in the air. I believe we have air superiority today, but that capability is eroding. We have it today because our airplanes and our pilots are superior to those of the Soviets. But the Soviets are introducing new airplanes--the MIG-23, the Modified MIG-25, and the MIG-27. These airplanes are not modeled on the simple, straight-forward designs of the MIG-19 and MIG-21. They are sophisticated, very capable, airplanes.

By the mid-1980s, while we still expect to have some advantage in airplane performance, it will be a narrow performance edge and perhaps not sufficient to compensate for the numerical advantage of Soviet air forces. They are now producing tactical aircraft at a rate about 2 times our rate and have been been doing so for several years. So we are facing a substantial problem.

My solution to that problem is maintain a critical performance edge. We could do that by increasing the aerodynamic performance of our aircraft,

providing greater speed, greater maneuverability and greater acceleration. In my view, we have reached the point of diminishing returns with improved aerodynamic performance; adding more aerodynamic performance will not provide a performance edge sufficient to warrant the added complexity involved. An alternative is to substantially improve the fire power of our aircraft and improve the tactical information systems which support their operations.

We are building a new missile called AMRAAM which will have a standoff range of about 30 or 40 miles. It will be able to engage more than one target at a time, and it will have a fire-and-soon-forget capability. This combination will provide a substantial tactical advantage relative to our present missiles or relative to any missiles which the Soviets will have in a comparable time frame.

We are also developing a new tactical information system which will present the pilot with what amounts to a situation display. It will show him where all of the other airplanes near him are located, who they belong to and what they are doing. This information will be extremely valuable if it is timely, accurate, and if we can present it in a simple form so the pilot can grasp it just by looking at a display.

We think the combination of presenting the pilot with that kind of information and giving him superior fire power will make <u>the critical difference</u> in dealing with airplanes which are almost as good as ours, but which outnumber us by 2 to 1. The missile will allow the pilot to engage, even if outnumbered, and the tactical information system is designed to minimize the probability of having to engage when outnumbered. That is, even if we are outnumbered globally, we don't have to be outnumbered locally if we know where everybody is located and can deploy accordingly.

So by selectively focusing and applying our technology, we can maintain the performance edge critical to maintaining air superiority. Microelectronics technology will play a critical role both in maintaining air superiority and in providing the next generation of electronics critical to our future anti-tank guided missile systems.

Application of Technology to Reduce Complexity

I have discussed the application of technology to gain the performance edge critical to our forces in the face of a numerically superior opponent. But technology can also be applied to simplify the operation of our systems and reduce maintenance. Many of the problems we are experiencing with reliability and maintainability are unfairly blamed on high technology; the problems are often the result of old systems in need of modernization. But we have not been as effective as we could be in fully exploiting our technology to simplify the operation and maintenance of our systems.

Technology can be employed in many ways. It can be used to make weapon systems simply elegant. But it can also be used to make weapon systems elegantly simple, and in so doing decrease the requirements on military manpower.

Just as civilian users of pocket calculators or video games do not need in-depth knowledge of the semiconductor technology which makes such devices possible, so military users of systems utilizing our high technology need no specialized technical knowledge about the technology involved to use these systems effectively. Users of the Global Positioning System need only be trained to operate the receiving equipment, they do not need to understand the details of how the satellites, clocks, and other sophisticated equipment operate. In this sense, the technology is "transparent"; the user sees the end result and not the technology which makes the operation possible.

I would now like to illustrate the application of our technology to reduce operational complexity with some specific examples.

Precision Guided Weapons

We have begun the expedited development of a third generation of precision-guided weapons. These new weapons will have major advantages over present systems. They will operate in nearly all weather conditions, be "fire-and-forget," and be capable of destroying the target on the first shot. If properly designed, this third generation of precision guided weapons will reduce the operational burden of the launch crew, reduce their vulnerability, and reduce the need for extensive crew training (since the weapon can be aimed and fired without the need for crew guidance of the weapon to the target).

These new weapons find, home-on and kill targets, and also have built-in test (BIT) and checkout circuits which allow the operator to push a button and get a "go" or "no go" indication as to the weapon's operational status.

Automatic Test Equipment (ATE)

At the same time that we are applying technology to greatly improve the effectiveness and utility of our military systems, we are faced with growing shortages of qualified operating and maintenance personnel. Some of these pressures support the drive to more easily operated and maintained equipment. Devising proper automatic test equipment will help us do our job.

As an example of the impact of ATE on manpower requirements, the crew of USS Eisenhower requires 48 hours to check its electronic warfare systems. A mobile dockside automatic test system can do the same job in 30 minutes. A recent study of the Navy's Operational Readiness Monitoring System illustrated that for small combatants, the ATE system saves 745 manhours per week. Likewise, an Air Force study showed that ATE provided a 50:1 to 100:1 test time reduction over manual testing for digital circuit boards. These manhour savings translate into a significant reduction in maintenance manpower and cost, and also impact operational readiness.

Built-In-Test (BIT)

Our technology can be used to test for, identify, isolate, and reconfigure failures in a component or subsystem so that they do not result in total system failure. Our efforts along these lines have been called built-in-tests (BIT). The potential benefits of BIT are in improved readiness, reduced time to repair, reduced maintenance manpower requirements, lower spare parts requirements and improved test station productivity. The average cost of adding BIT to a weapon system is roughly 10% of the system acquisition cost. An average life cycle cost savings of about 35% has been achieved on systems which average a 5/2 ratio in life cycle cost to acquisition cost. Thus, the return on investment with BIT is roughly 8.75 to 1.

A recent industry/joint Service automatic test project study identified a 30% improvement in system availability as a consequence of BIT and improved methods of testability. The same study highlighted the impact of automatic test in support of nonelectronic systems and equipment. Enhanced maintenance of ships, trucks and tanks is projected to provide a 30% reduction in maintenance manhours per operating hours, a potential 20% reduction in the cost of spares, and a potential 10% reduction in fuel consumption of internal-combustion engine-powered equipment.

Simulators and Training Devices

Another area where proper application of our technology can pay large dividends is in simulators and training devices. Early identification of manpower, logistics and training demands is in line with OMB Circular A-109, which stresses the need for front-end analysis as a part of the early planning and system definition phase.

Through the use of inexpensive learning and entertainment devices, such as are now found in homes and arcades across the nation, we hope to be able to train our personnel more effectively in less time. The quicker we get them

out of school and into the operational unit, the more time they will have to work productively during their term of Service.

We know from an evaluation of Navy and Air Force data that computer-assisted/managed instruction, which is an individualized method of instruction, is as effective in training military personnel as conventional, classroom instruction. It also saves about 30 percent of the time needed to complete technical training courses. Training systems such as these will help us speed new recruits to their initial assignment and allow them to spend more useful time on the job. We anticipate that the next step is to miniaturize such devices and, by making them portable with self-contained computational power, have them available for remedial or advanced instruction at all bases or locations. Such systems will also be able to prescribe individually tailored instruction to meet particular job assignments. One of our "brassboard" systems in our Very High Speed Integrated Circuits Program is devoted to just such an application. The use of microprocessors and even faster, cheaper integrated circuits will make such devices not only possible, but relatively inexpensive.

System maintenance is a headache which seems to afflict even the most efficient systems. Often our problems are not organic at all, but are due to human error over which we could have some control. For example, a series of surveys indicated that from 14 to 35 percent of the corrective maintenance actions which occurred over one year involved the removal of non-faulty parts. These actions consumed from 9 to 32 percent of the maintenance manhours actually spent. Therefore, we have placed increased emphasis on finding better ways of training maintenance technicians. Our programs range from the development of computer-controlled simulators for training maintenance procedures associated with avionics, propulsion, radar, communications, etc., to developing more generic training aids and devices which can be moved to

and from the work areas. These simulators can function like actual equipment for training purposes, but with improved safety and convenience. Current examples show the simulators being from 10 to 50 percent the cost of trainers using actual equipment. They can also demonstrate a wider range of malfunctions than can be arranged in actual equipment and are usually much less expensive to buy.

The original push for simulation came from the aviation community. Since WWII, flight simulators have been used for procedure and instrument training. However, with the fuel crisis of 1973, we have placed continued and increasing emphasis on the utilization of flight simulators to save fuel, improve performance and reduce training related accidents. Numerous studies both by DoD and the airlines have shown that it is cost-effective to utilize simulators for training in many of the flying tasks. For example, we know that the cost of operating flight simulators is about 5 to 20 percent that of their comparable aircraft. Pilots trained in simulators reduce the time required to train in-flight with the actual system by about 50 percent. But cost savings are not the only benefit. The Air Force has recently demonstrated that students trained on an A-10 simulator were ready to land sooner and could be qualified the first time they went to the range to drop bombs. In general, they far surpassed the A-10 students who did not use the simulators.

A continuing problem plaguing those who must provide tactical training is how to realistically simulate engagements. We have done this by developing laser "bullets" -- eye-safe, battery-operated gallium arsenide pulse coded lasers. Exercises using this MILES (Multiple Integrated Laser Engagements System) are planned for the National Training Center. They will allow battalion size exercises that will provide a method for casualty assessment, enable a critique of two-sided engagements and allow for training repetition

using various tactics and weapons. Recent exercises in Germany using MILES have brought praise from commanders and troops alike. This method of training is being seriously considered by many European countries. We will soon be evaluating a tank gunnery system using the MILES approach.

Summary

In these few pages I have described our offset strategy of applying technology to counteract a numerical disadvantage in military equipment. To be effective, our technology must be applied selectively to achieve a performance edge which is critical to the outcome of engagements. I have also discussed the application of technology to counteract the pressures resulting from shortages of qualified operating and maintenance personnel. Our objectives are to apply technology to improve reliability and maintainability; to use our technology to make servicing and testing equipment much less labor intensive; and to use the exploding technology of microprocessors in automatic test equipment, built-in-test, and in simulators and training devices that enable our forces to effectively and efficiently operate and maintain their equipment.